JUL 1 1986

COMPLETED

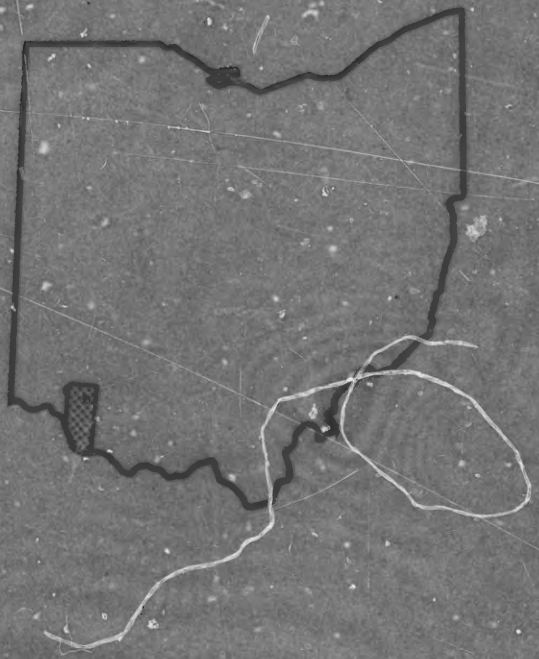
FEM 1.209:390214

ORIGINAL

FLOOD INSURANCE STUDY

VILLAGE OF EVENDALE, OHIO

HAMILTON COUNTY



SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER-390214

BEST COPY AVAILABLE

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	6
4.1	Flood Boundaries	7
4.2	Floodways	7
5.0	INSURANCE APPLICATION	9
6.0	FLOOD INSURANCE RATE MAP	10
7.0	OTHER STUDIES	10
8.0	LOCATION OF DATA	10
9.0	REFERENCES AND BIBLIOGRAPHY	10

BEST COPY AVAILABLE

TABLE OF CONTENTS (Continued)

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 9

TABLES

Table 1 - Summary of Discharges 5

Table 2 - Floodway Data 8

EXHIBITS

Flood Profiles

Mill Creek	Panel	01P
Sharon Creek	Panel	02P
Sharon Creek Tributary	Panel	03P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

Elevation Reference Marks

BEST COPY AVAILABLE

FLOOD INSURANCE STUDY

VILLAGE OF EVENDALE,
HAMILTON COUNTY,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Evendale, Hamilton County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Louisville District (the Study Contractor), for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-84-E-1506, Project Order No. 1. This study was completed in June 1985.

1.3 Coordination

Streams requiring detailed study were identified at a meeting on June 13, 1979, attended by representatives of the Study Contractor, FEMA, and the Village of Evendale.

On November 1, 1985, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

BEST COPY AVAILABLE

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Evendale, Hamilton County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of Mill Creek, Sharon Creek, and Sharon Creek Tributary within the corporate limits was studied in detail.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through June 1990. The scope and methods of study were proposed to and agreed upon by FEMA and the Village of Evendale.

2.2 Community Description

The Village of Evendale is located in northeastern Hamilton County in the extreme southwestern corner of Ohio. It is bordered on the west by the Village of Woodlawn, on the south by the City of Lockland and the City of Reading, on the east by the City of Blue Ash, and on the north by the City of Sharonville. According to the 1980 census, the population decreased from 1,967 in 1970 to 1,954 in 1980 (Reference 1).

The climate of Hamilton County is classified as continental. Summers are moderately warm and humid with frequent days when temperatures exceed 90 degrees Fahrenheit. Winters are cold and cloudy, but days with subzero temperatures are rare. The prevailing wind is from the southwest. Precipitation is considerable in January, March, and June. Fall is typically the driest season. The mean annual precipitation is 38.12 inches (Reference 2).

Mill Creek flows in a southerly direction and has a drainage area of 50.4 square miles above the confluence of Sharon Creek. Sharon Creek flows in a southwesterly direction to its confluence with Mill Creek at mile 15.952 and has a drainage area at the mouth of 10.5 square miles.

The development within the flood plain of Mill Creek and Sharon Creek is primarily industrial.

2.3 Principal Flood Problems

Much of the dense industrial development along Mill Creek in Evendale is subject to flooding. Flooding occurs when Mill Creek cannot convey floodwaters generated from the basin. The January 1959 flood in which 5 to 6 inches of rain fell on the frozen Mill Creek watershed is an example. This type of flooding can result from either regional rainstorms or locally intense thunderstorms.

BEST COPY AVAILABLE

BEST COPY AVAILABLE

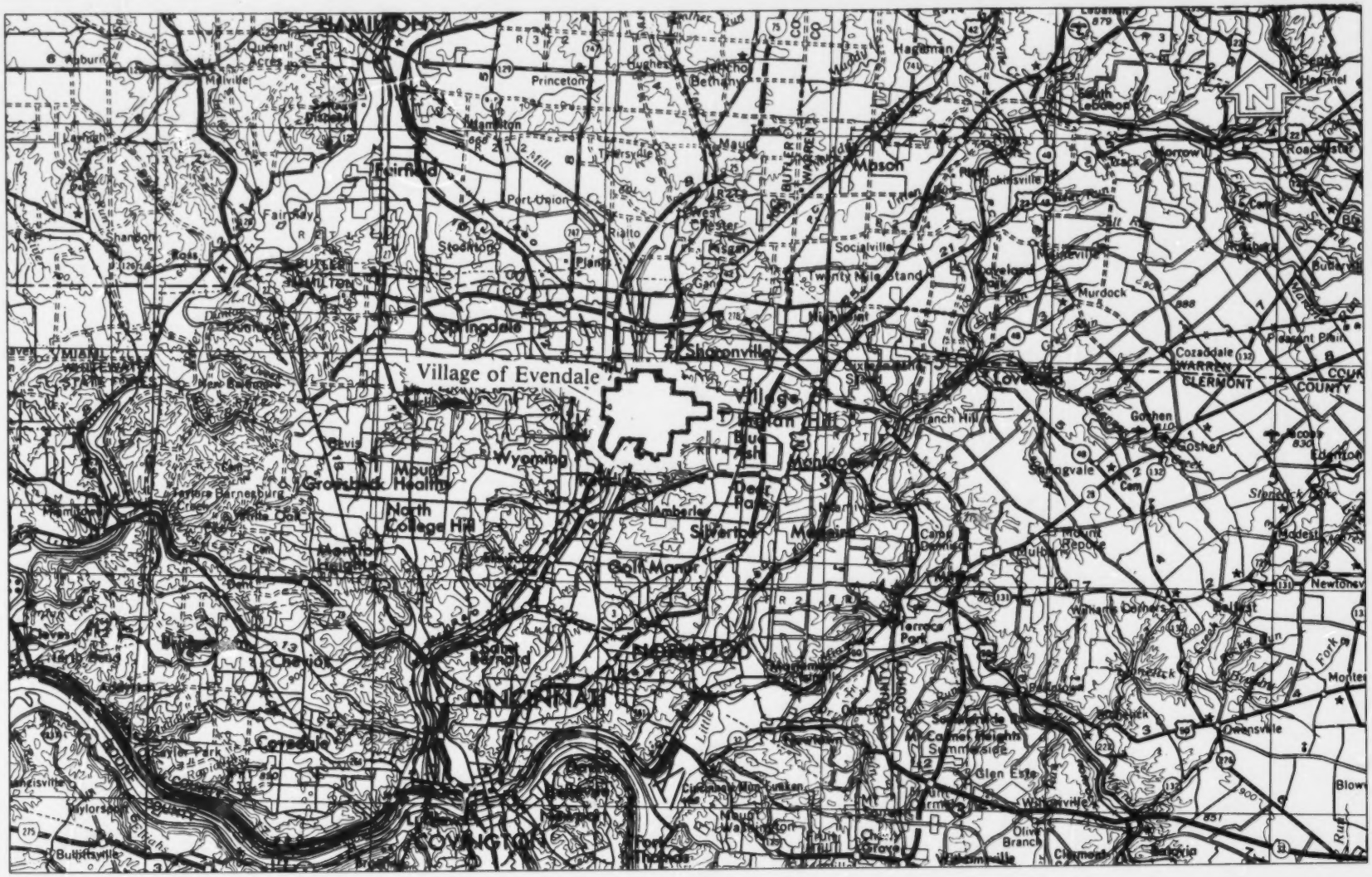


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF EVENDALE, OH
(HAMILTON CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The smaller watersheds also experience flooding as a result of locally intense thunderstorms. This type of flooding would typically be expected on Sharon Creek.

2.4 Flood Protection Measures

There are two levees in the Village of Evendale. One follows Mill Creek on its western bank and the other is built around the filtration plant. Neither levee is certified for the 100-year flood and does not contain the flood.

Levees exist in the study area that provide the community with some degree of protection against flooding. However, it has been ascertained that these levees may not protect the community from rare events such as the 100-year flood. The criteria used to evaluate protection against the 100-year flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 100-year flood are not considered in the hydraulic analysis of the 100-year flood plain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (one-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Final frequency-discharge values for Mill Creek were based on gage analyses of two gages located on Mill Creek. A frequency-discharge versus drainage area relationship was developed using these gages and pertinent values were taken from the relationship.

The regional frequency study used in the Flood Insurance Studies for the City of Cincinnati and Hamilton County was used as the basis for selecting flow quantities on Sharon Creek. This study, entitled, "Eastern Kentucky

BEST COPY AVAILABLE

Regional Frequency Study" (Reference 3), was an indepth analysis of U.S. Geological Survey (USGS) gaging stations located in the eastern part of Kentucky and adjacent areas. Final frequency-discharge values for Sharon Creek near its confluence with Mill Creek were transitioned from the "Eastern Kentucky Regional Frequency Study" to the Mill Creek frequency values to ensure consistency of discharge values.

Bulletin No. 17B guidelines (Reference 4) were used in developing both of the above frequency studies. Determination of the final discharge versus drainage area relationships considered omission of low and high outliers, weighting with the generalized skew, and historically adjusting the curves where possible. Limited gage data in the vicinity of Evendale were compared to the regional study to assure reasonableness of the adopted discharge values.

Hydrologic computations for all streams studied by approximate techniques utilized the "Eastern Kentucky Regional Frequency Study" (Reference 3).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MILL CREEK					
just above confluence of Sharon Creek	50.4	3,820	5,060	5,680	7,010
SHARON CREEK					
at mouth	10.5	3,500	5,050	6,000	8,350
at Reading Road	5.8	3,180	4,730	5,650	8,200
SHARON CREEK TRIBUTARY					
at mouth	3.55	1,700	2,110	2,590	4,050

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections were located at regular intervals along the stream length and at significant changes in ground relief and land use or land cover. Channel and overbank were obtained from field measurements and supplemented by 1:2400 and 1:600 scale aerial photographic mapping with 5- and 1-foot contour intervals, respectively (References 5 and 6). All bridges and culverts were field surveyed to obtain elevations and structural geometry. Water-surface profiles were developed using the HEC-2 step-backwater computer model (Reference 7). Profiles were determined for the 10-, 50-, 100-, and 500-year floods.

BEST COPY AVAILABLE

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") depend on such factors as type and amount of vegetation, channel configuration, and water depth. Field inspection at each cross section provided estimated values. In conjunction with this approach, known roughness factors for comparable streams in adjacent watersheds were considered. In addition, 1959 flood high-water marks were reproduced to verify the roughness values for Mill Creek. Roughness coefficients developed for this report are shown below.

Manning's Roughness Coefficients

Stream	Channel Roughness	Overbank Roughness
Mill Creek	0.040-0.045	0.075
Sharon Creek	0.040	0.065-0.075
Sharon Creek Tributary	0.045	0.060

Starting water-surface elevations for Mill Creek and Sharon Creek Tributary were determined by the slope-area method. A range of starting slopes was used to test the sensitivity and reasonableness of the adopted values.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been drawn.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

BEST COPY AVAILABLE

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the one-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:2400 and 1:600 with contour intervals of 5 feet and 1 foot (References 5 and 6).

For the streams studied by approximate methods, only the 100-year flood plain boundary was delineated using the Flood Hazard Boundary Map for the Village of Evendale (Reference 8).

The 100- and 500-year flood plain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100-and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the flood plain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
MILL CREEK								
A	14.700	123	1057	6.2	558.8	558.8	559.5	0.7
B	14.877	110	928	7.1	560.9	560.9	561.3	0.4
C	15.021	100	932	7.1	562.3	562.3	563.0	0.7
D	15.053	89	909	7.3	562.8	562.8	563.4	0.6
E	15.127	113	1021	6.5	563.7	563.7	564.2	0.5
F	15.350	107	1225	5.4	565.5	565.5	566.1	0.6
G	15.659	83	1039	6.4	567.3	567.3	568.1	0.8
H	15.732	100	1049	6.3	567.6	567.6	568.2	0.6
I	15.963	102	1014	5.6	569.5	569.5	570.4	0.9
J	15.982	119	1335	4.3	570.3	570.3	571.3	1.0
K	16.015	110	1063	5.3	570.3	570.3	571.3	1.0
L	16.034	101	1038	5.5	571.0	571.0	572.0	1.0
M	16.150	100	1165	4.9	571.8	571.8	572.6	0.8
N	16.400	120	1204	4.7	573.1	573.1	573.8	0.7
O	16.667	127	1401	4.1	574.5	574.5	575.3	0.8
P	16.800	142	1374	4.1	575.4	575.4	576.2	0.8
Q	16.874	130	1309	4.3	575.6	575.6	576.6	1.0
SHARON CREEK								
A	0.058	133	955	6.3	570.5	570.5	571.5	1.0
B	0.298	159	1051	5.7	574.2	574.2	575.0	0.8
C	0.546	141	1179	5.1	577.3	577.3	578.3	1.0

[1]MILES ABOVE MOUTH

BEST COPY AVAILABLE

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF EVENDALE, OH

(HAMILTON CO.)

FLOODWAY DATA

MILL CREEK—SHARON CREEK

The area between the floodway and the 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

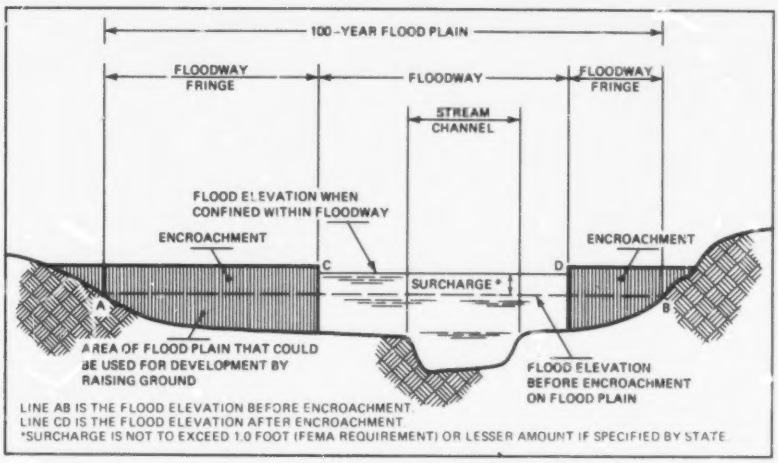


FIGURE 2 - Floodway Schematic

The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

BEST COPY AVAILABLE

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols the 100- and 500-year flood plains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Flood Insurance Studies are being conducted for the Cities of Sharonville, Reading, Lockland, and the Village of Woodlawn (References 9-12). In addition, a Flood Insurance Study was completed in February 1980 for the City of Blue Ash (Reference 13).

The results of this study match exactly the results of the above-mentioned studies.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the Village of Evendale (Reference 8).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Ohio, Washington, D.C., February 1982.

2. Ohio Department of Natural Resources, Division of Lands and Soils, Progress Report No. 60, An Inventory of Ohio Soils, Hamilton County, 1980.

3. U.S. Army Corps of Engineers, Louisville District, Eastern Kentucky Regional Frequency Study, Louisville, Kentucky, August 1976.

BEST COPY AVAILABLE

4. Interagency Advisory Committee on Water Data, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, 1981.

5. Metropolitan Topographic Survey, Topographic Mapping, Scale 1:2400, Contour Interval 5 feet: City of Cincinnati and Hamilton County, Ohio, 1965.

6. International Aerial Mapping Co., Topographic Mapping, Altitude 1500', Scale 1:600, Contour Interval 1 foot: San Antonio, Texas, January 1973.

7. U.S. Army Corps of Engineers, Hydrological Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

8. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Evendale, Hamilton County, Ohio, March 1974.

9. Federal Emergency Management Agency, Flood Insurance Study, City of Sharonville, Hamilton County, Ohio, in progress.

10. ————, Flood Insurance Study, City of Reading, Hamilton County, Ohio, in progress.

11. ————, Flood Insurance Study, City of Lockland, Hamilton County, Ohio, in progress.

12. ————, Flood Insurance Study, Village of Woodlawn, Hamilton County, Ohio, in progress.

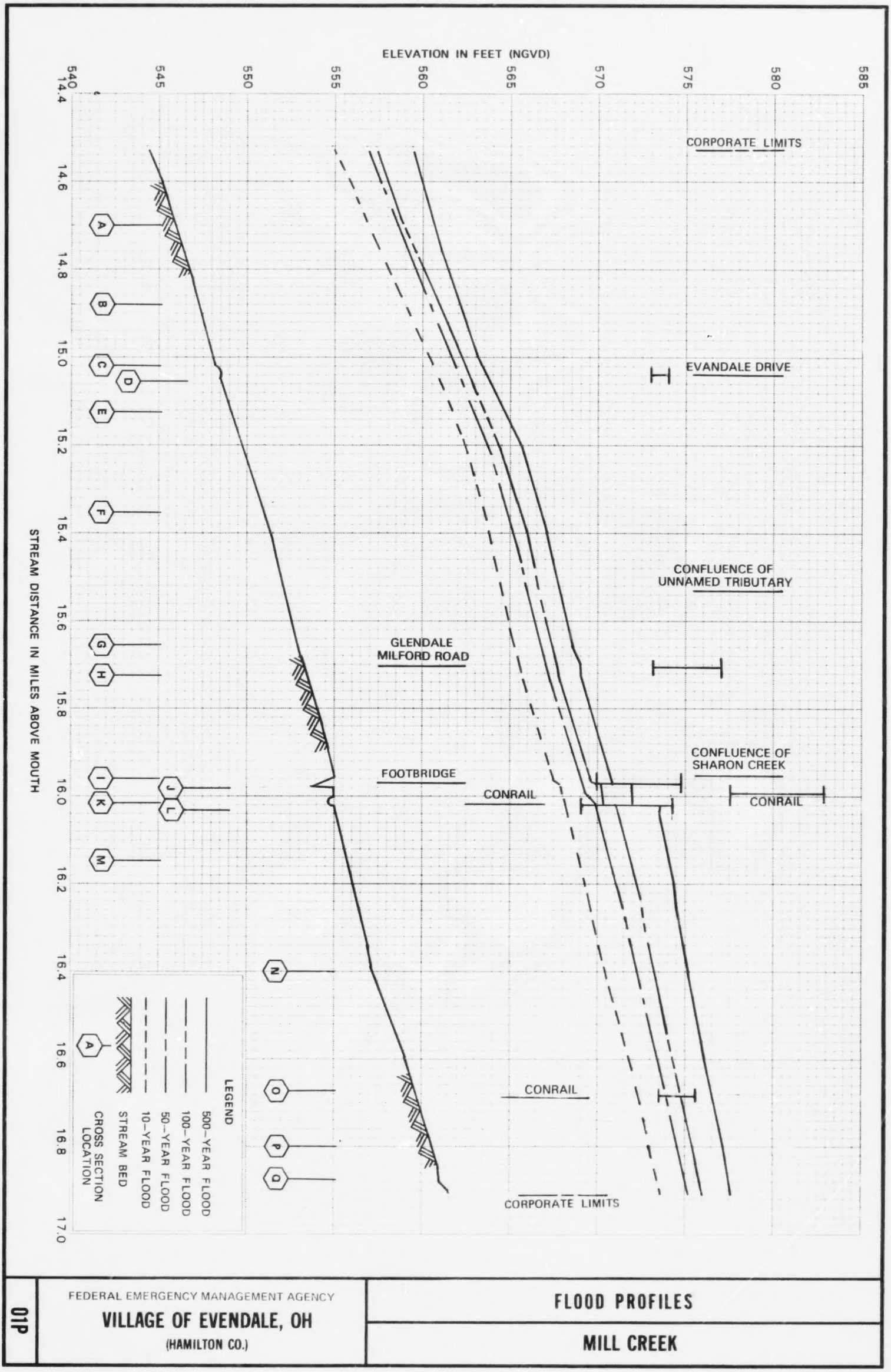
13. ————, Federal Insurance Administration, Flood Insurance Study, City of Blue Ash, Hamilton County, Ohio, February 1980.

BEST COPY AVAILABLE

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0002	581.58	a mark located on Reading Road, 0.30 mile north of Cooper Road, 1.5 feet west of west curb
2	0001	578.53	a mark located on Reading Road at intersection of Glendale-Milford Road, 34.7 feet north of centerline of Glendale-Milford Road, 2.1 feet west of the west edge of the pavement of Reading Road

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF EVENDALE, OH

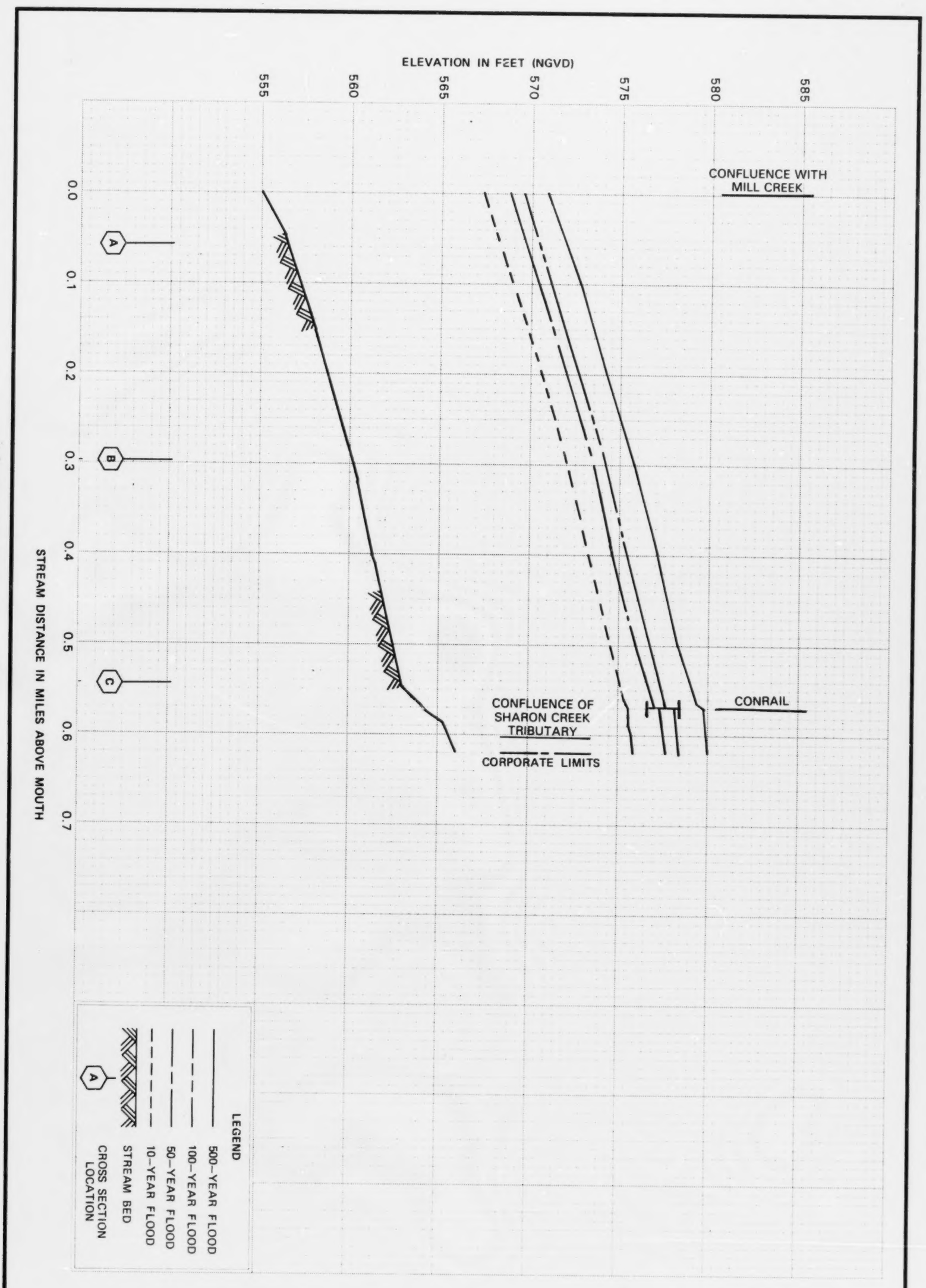
(HAMILTON CO.)

FLOOD PROFILES

MILL CREEK

01P

BEST COPY AVAILABLE



02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

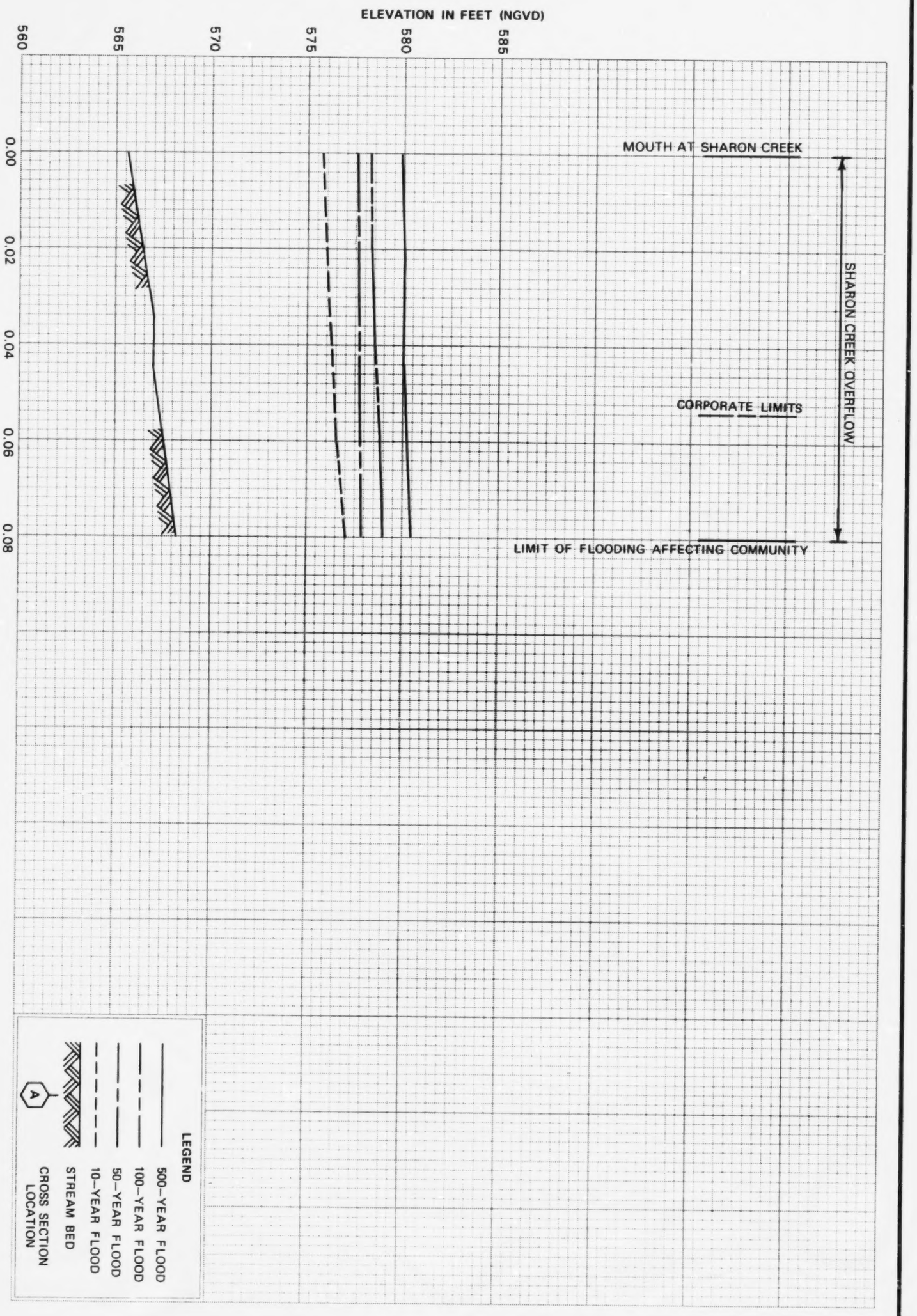
VILLAGE OF EVENDALE, OH

(HAMILTON CO.)

FLOOD PROFILES

SHARON CREEK

BEST COPY AVAILABLE



BEST COPY AVAILABLE

15

03P	FEDERAL EMERGENCY MANAGEMENT AGENCY **VILLAGE OF EVENDALE, OH** (HAMILTON CO.)	**FLOOD PROFILES** **SHARON CREEK TRIBUTARY**